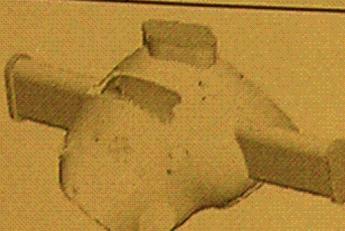
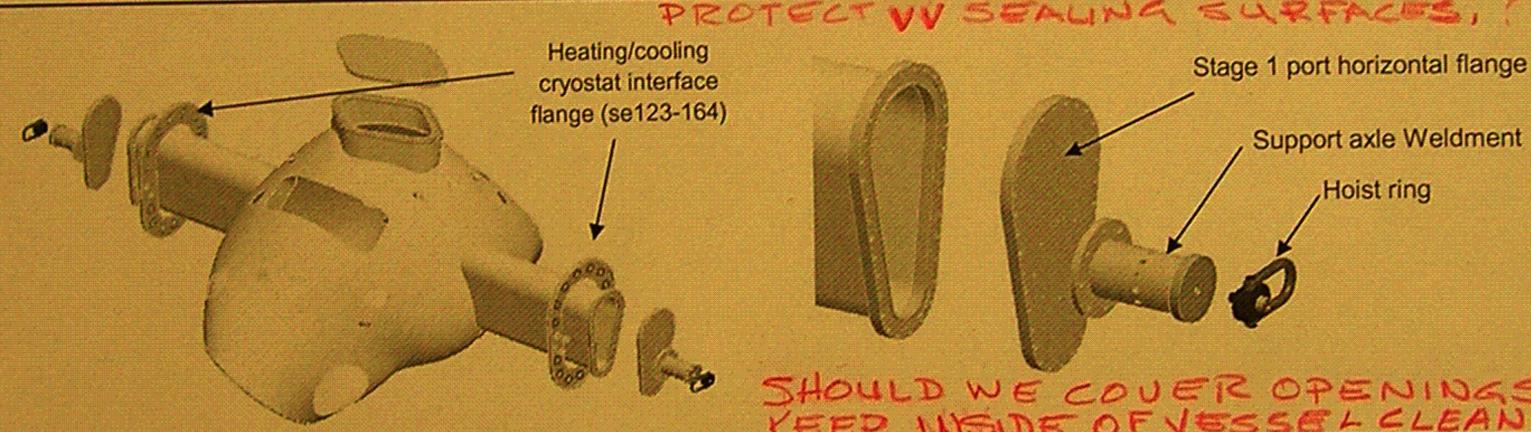
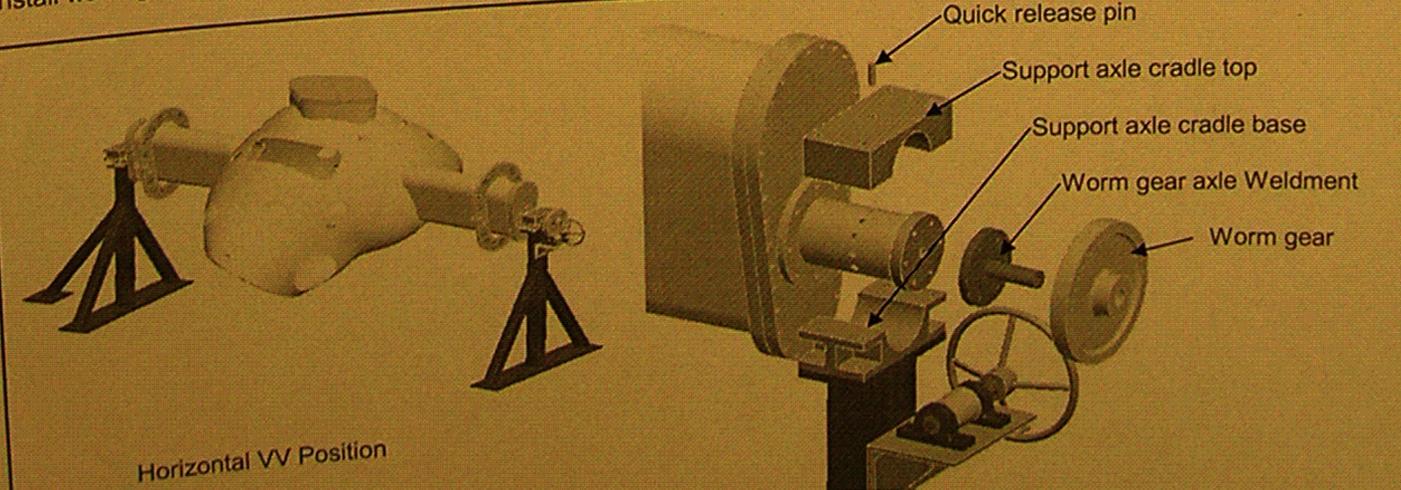


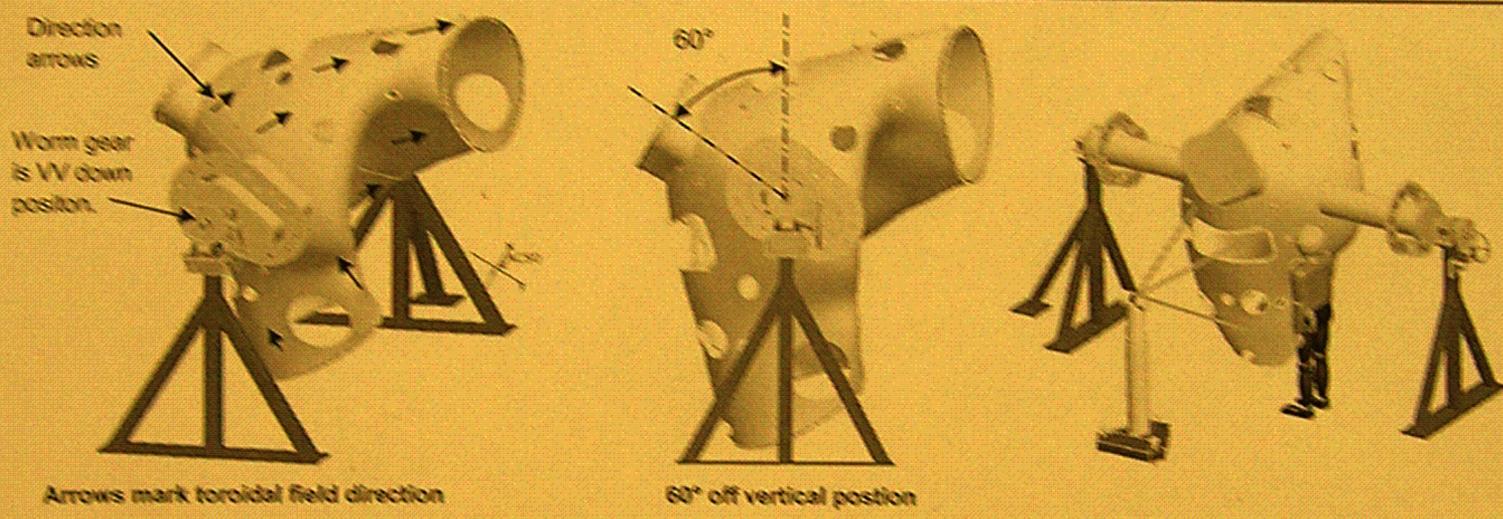
~~How will this be shipped?~~  
~~What orientation will this vessel be in during inspection?~~  
~~How will it be supported?~~



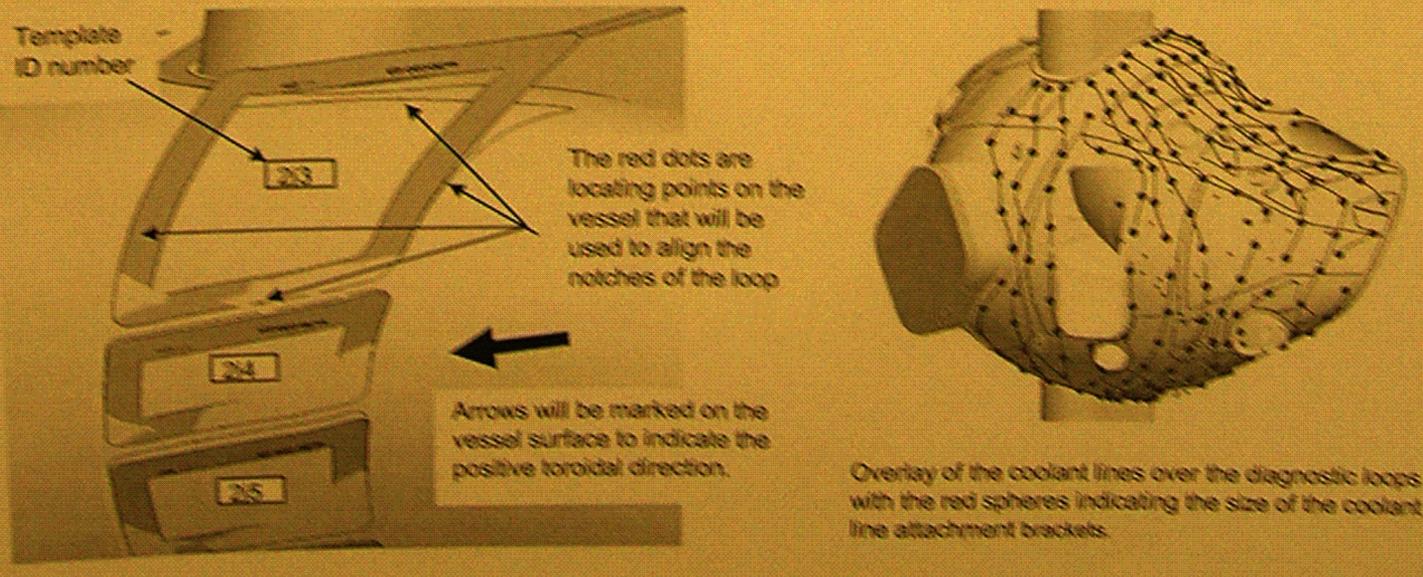
**Stage 1 (Vacuum Vessel Preparation)**

Item	Assembly Step	Comments
1.0	Receive VV and Inspect	Receive and perform visual inspection. Take metrology measurements.
		<p>VERIFY ALL TOOLING BALL LOCATIONS COMPARE @ MAJOR TOOL - RESOLVE ANY DIFFERENCES.</p> <p>RESOLVE IMPACT OF OUT OF TOL CONDITIONS</p> <p>MEASURE END FLGS COMPARE WITH THEORETICAL (PRACTICE FOR MACH. SPACER)</p>
2.0	Replace port flanges with Stage 1 assembly flanges	Reference drawing: se184-001
2.1	Remove two horizontal port flanges	Horizontal ports have 32 bolt assemblies; bag hardware for future use
2.2	Remove horizontal port vacuum seal	"White glove" removal needed to protect the vacuum surface. Bag for future use.
2.3	Remove NB port flange and hardware	NB port has 34 bolt assemblies; bag hardware for future use
2.4	Remove NB port vacuum seal	"White glove" removal needed to protect the vacuum surface. Bag for future use.
2.5	Slip VV heating/cooling cryostat interface flange over each vertical port.	The VV heating/cooling cryostat interface flanges need to be temporarily located on the vertical ports as the Stage 1 support fixture will inhibit their installation. Reference drawing: se123-164.
2.6	Attach Stage 1 port flanges	Insert bolt assemblies into every other hole. The support axle Weldment and hoist rings should be preassembled to the vertical port flanges.
	 <p>PROTECT VV SEALING SURFACES, ?</p> <p>SHOULD WE COVER OPENINGS TO KEEP INSIDE OF VESSEL CLEAN?</p>	<p>DOES IT MEET ALL SPEC &amp; DNG REQMS</p> <p>LIST WHAT INSP ARE NEEDED</p> <p>CHK TO SEE IF METAL SEAL IS SHIPPED W/ PART.</p> <p>IF SO DO WE WANT TO REMOVE</p> <p>DO NOT TOUCH INSIDE OF VESSEL WITHOUT WHITE GLOVES.</p>
3.0	Check CG then mount on Prep fixture	Reference drawing: se184-001
3.1	Lubricate support axle and axle support cradle.	Add lubricate to the support axle Weldment and support axle cradle components (cradle top and cradle base) to reduce VV rotation friction.
3.2	Check VV CG	Using crane with attachment to hoist rings lift from a horizontal position and rotate vessel to a vertical position. Check to see if the part is in a near vertical position. Mark CG location.
3.3	Condition for resetting support axle Weldment	If CG is found to be off by a value greater than 2.0" return VV to its original position. Remove and relocate support axle Weldment to the proper CG location.
3.4	Mount VV on VV Prep fixture	Set VV on the Stage 1 Prep station support fixture in a horizontal position. Secure in place by bolting down support axle cradle top support blocks. Install quick release pin.
3.5	Install worm gear	Remove the hoist ring from the VV on the side with the worm gear support. Install worm gear axle Weldment and worm gear, engaging worm wheel.
	 <p>Horizontal VV Position</p>	<p>HOW WILL YOU CHECK THE CG?</p>

Item	Assembly Step	Comments
4.0	Metrology set-up and initial vessel settings	Reference drawing: XXXXXXXXXXXX ProE model XXXXXXXX
4.1	Mark positive toroidal field direction	Using a marker mark the positive toroidal field direction on the front and back surface of the vacuum vessel. Note that the worm gear system is identified as the VV down direction. See figure below for field direction marking.
4.2	Set up measurement fiducials provided by MTM plus add additional monuments as specified in FP Dimensional Control Plan. Rotate vessel to convenient access positions.	FP Dimensional Control Plan: XXXXXXXXXXXX Note that some monuments will be located on the body of the VV.
4.3	Perform a best fit to the fiducial measurements using the monuments on the VV body.	Settings will be made with the vessel NBI port at a +/- 60° off vertical position as indicated below. Secure vessel position by inserting release pin and tighten support axle cradle bolts. Verify that the mounting system is rigid enough to meet FP Dimensional Control Plan metrology requirements. Add additional bracing if required.

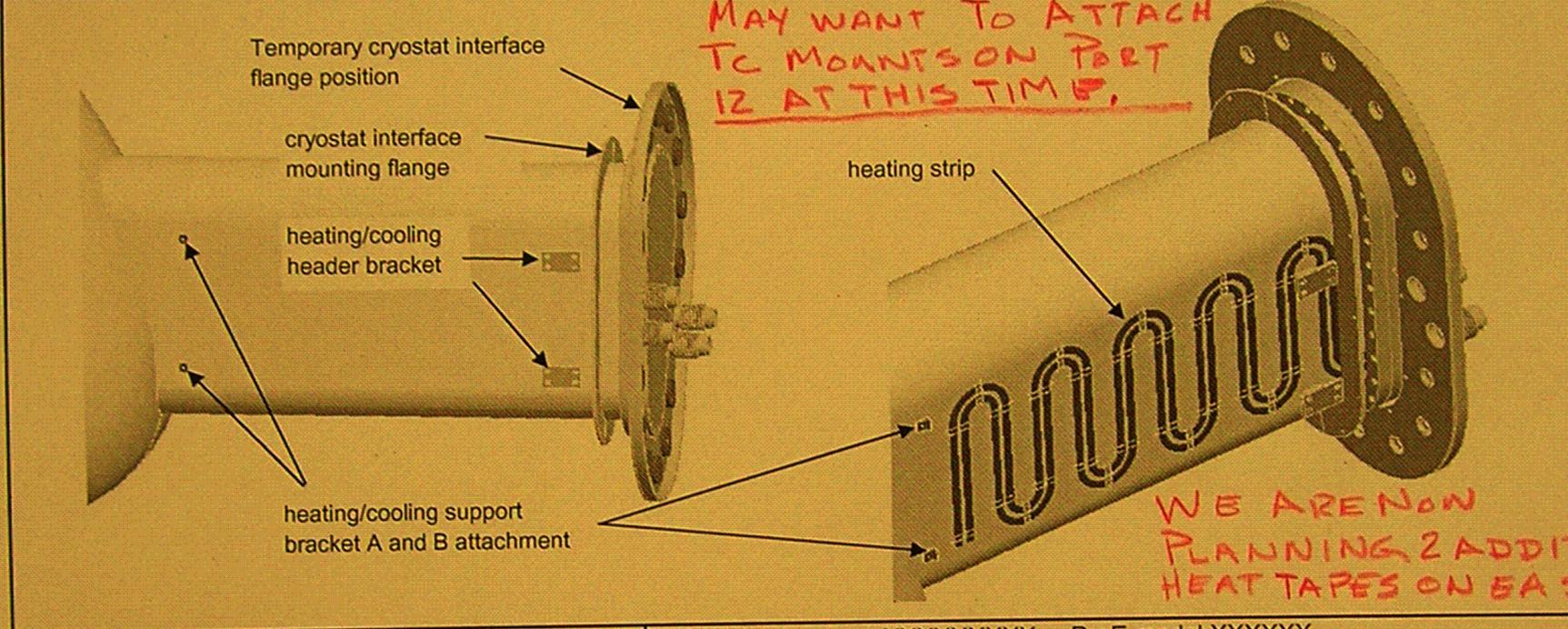


5.0	Magnetic loop and coolant line markings	FP Dimensional Control Plan: XXXXXXXXXXXX ProE model XXXXXXXX
5.1	Settings will be made with the vessel NBI port at a +/- 60° off vertical position	Secure vessel position by inserting release pin and tighten support axle cradle bolts.
5.2	Mark surface for 138 loop placement with the vessel NBI port at a +/- 60° off vertical position. It is expected that three Leica positions will be required on each side to accurately mark the vessel.	The Leica metrology system will be used to accurately define four marks (within +/- 0.040") for each of 138 loops except for the loops at the symmetry points which shall be positioned within +/- 0.010". The magnetic loop points shall be marked using an "X" to indicate the locating point. For ease of locating templates mark template number at the center of four points. See figure below and Reference drawing XXXXXX and ProE model XXXXXXXX for loop designation, point marking details and model geometry data.
5.3	Mark surface for coolant line stud placement with the vessel NBI port at a +/- 60° off vertical position.	The Leica metrology system will be used to locate 300 studs per half period at ~ 8" spacing. Fine accuracy is NOT important. The stud locations shall be marked with a circle and an outline of the coolant hold-down bracket will be marked. See figure below and Reference drawing XXXXXX for loop designation, point marking details and model geometry data.

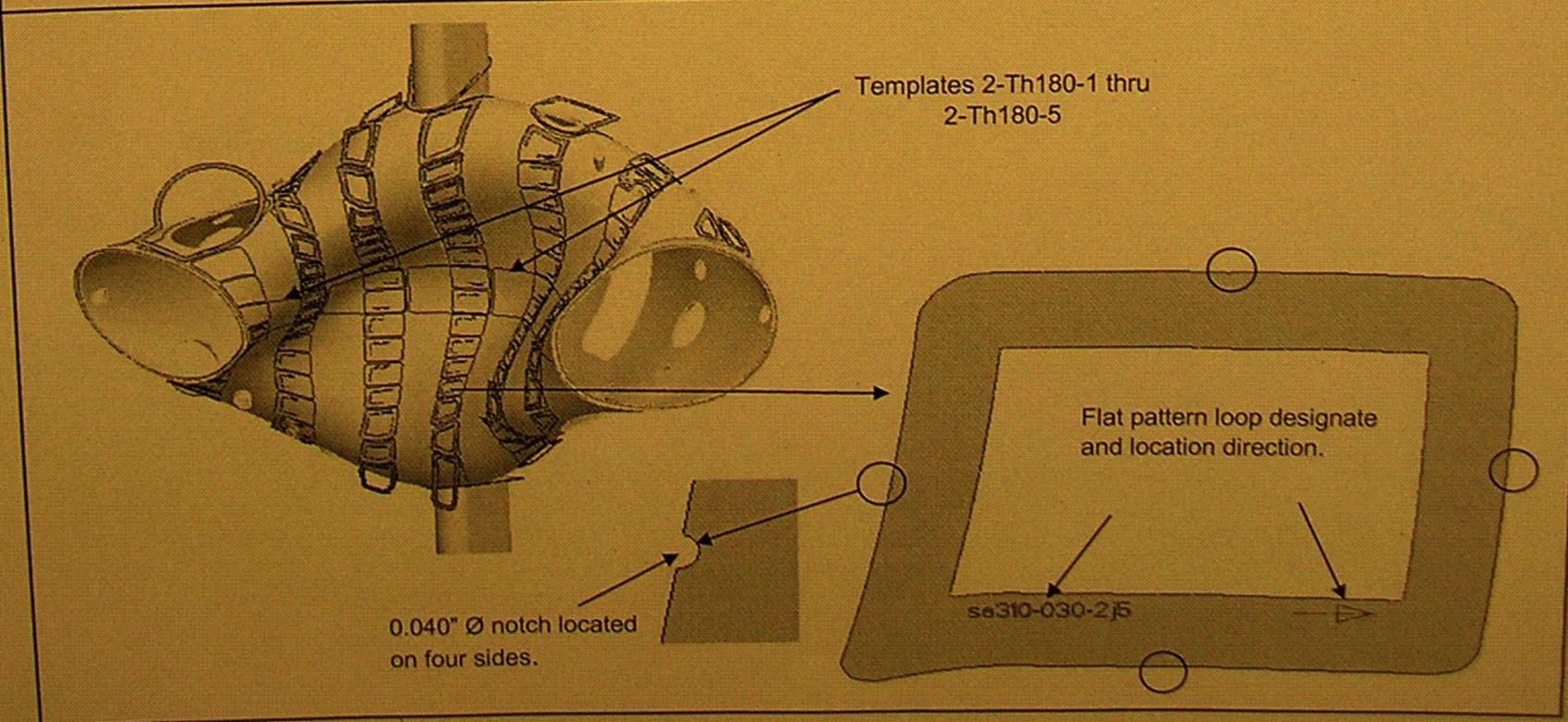




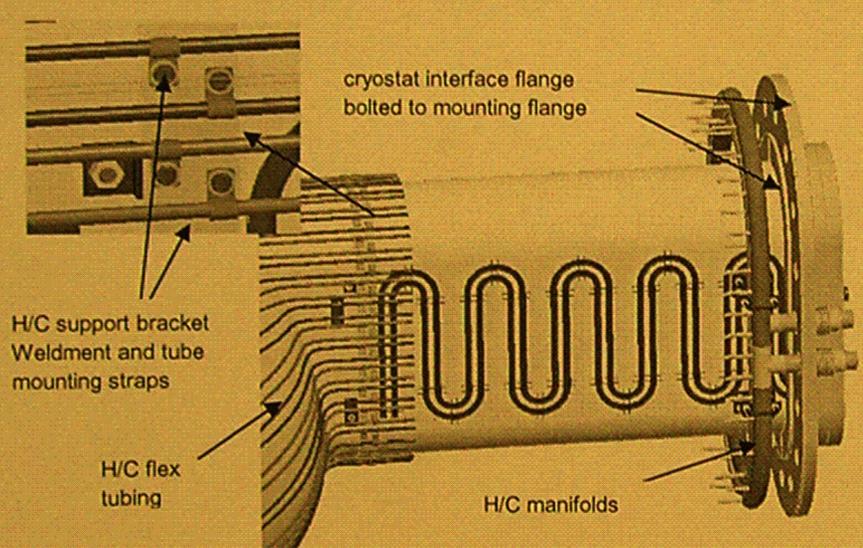
Item	Assembly Step	Comments
6.0	Vertical port component installations	Reference drawings: se123-049 and se121-005 (check drawings and content)
6.1	Mark heating/cooling support bracket A and B attachment studs and mark bracket clip outline.	
6.2	Install cryostat interface mounting flange on vertical ports	Before welding the interface flange on the vertical ports the cryostat interface flange must be moved to the proper assembly position (see figure below).
6.3	Install cryostat interface flange on vertical ports	
6.4	Install heating/cooling header brackets	
6.5	Install heating strips on vessel vertical ports	THERE ARE INTERFERENCES IN THE CURRENT ARRANGEMENT



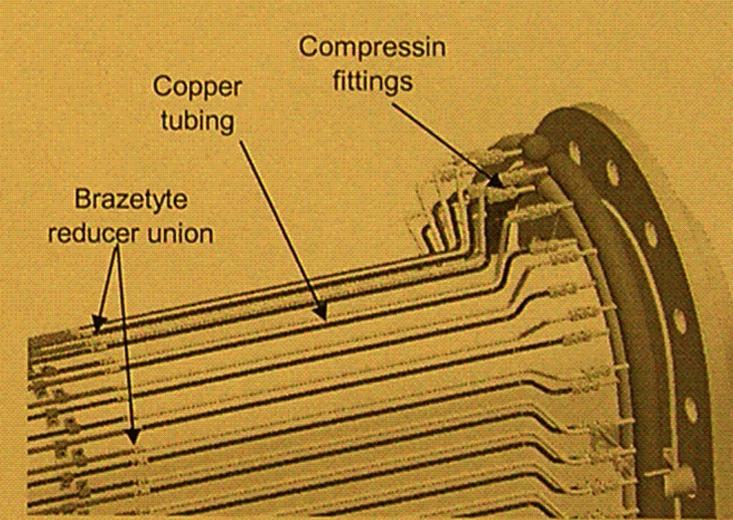
7.0	Install magnetic flux templates and flux loops	Reference drawing: XXXXXXXXXX ProE model XXXXXX FP Dimensional Control Plan: XXXXXXXXXX
7.1	Rotate VVSA to convenient installation position for installing loop templates <i>MAY WANT TO SHOW POSITIONS NEEDED FOR INSTALLATION OF LOOPS.</i>	Each loop template has four locating notches which shall be used to install loops to within $\pm 0.160$ " of the marked locations, except for the loops at the symmetry points which shall be positioned within $\pm 0.020$ ". The locating direction arrow should be aligned in the general direction of the positive toroidal field direction arrows marked on the vessel surface.
7.2	Template placement order	Templates 2-Th180-1 thru 2-Th180-5 need to be placed and the flux loop wires run before adjacent loops are placed because of local template interferences.
7.3	Install all remaining flux loop templates	Except for the above mentioned wire runs, all remaining templates shall be installed before any loop wires are run.
7.4	Install loop wires and wire leads, then remove templates	Refer to drawing YYYYYY and ProE model YYYY for guide in running leads
7.5	Install voltage loops	Refer to drawing YYYYYY and ProE model YYYY for guide in running voltage loops.



Item	Assembly Step	Comments
8.0	Final loop measurement and H/C Installation	Reference drawing: XXXXXXXXXX ProE Model: ZZZZZZZZ FP Dimensional Control Plan: XXXXXXXXXX
8.1	Install H/C tube studs	The flux loops leads can be temporarily moved to facilitate this process
8.2	Attach H/C tube clamp hardware used for mounting coolant lines.	
8.3	Perform final flux loop lead tie down	Perform final routing of flux loop leads and hold down with spot-welded shim stock straps spaced approximately 4" apart. (Is this the correct value?) Note that the radial build of the twisted leads should not exceed 1/8", except in a few places (not under H/C tube paths) where it may be necessary for one set of leads to cross another.
8.4	Install thermocouple mount plates	Reference drawing: se121-004
8.5	Measure as-built paths of flux loops	Measure as-built paths of flux loops to within $\pm 0.25$ mm (0.010"). This shall be done by tracing the groove between the two turns of each loop using a Laser Tracker probe with a small tip.
8.6	Install H/C tube support brackets	Install H/C support bracket Weldment A and B and tube mount strap. See figure below. Reference Drawing: se121-008
8.7	Secure H/C cryostat flange and H/C manifolds	See figure below. Reference Drawings: se121-008, se123-049
8.8	Install H/C flex tube	See figure below. Reference Drawings: se121-008, se123-049
8.9	Install H/C hard tubing	See figure below. Reference Drawings: se121-008, se123-049



**Flex Tubing Installation**



**Hard Tubing Installation**

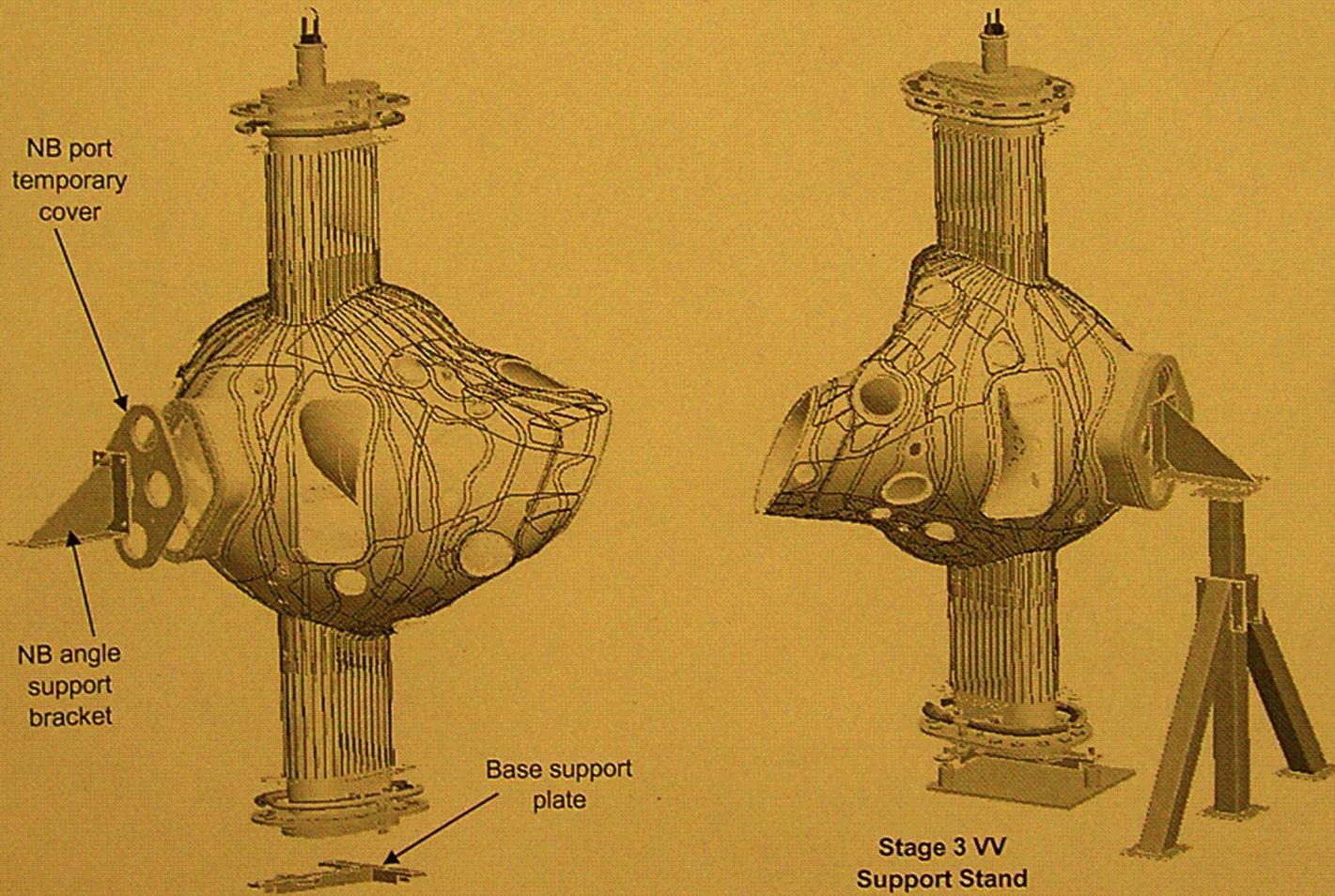
8.10 LEAK CHK TUBING

9.0	Loop termination and verification check	GEORGE LABIK TO ADD DETAILS
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WEEK	1	2	3						XX	XX	XX
<b>TASK</b>											
8.1				-----							
8.2				-----							
8.4									-----		



Item	Assembly Step	Comments
10.0	Prepare and transfer completed VV to holding area	Reference drawing: xxxxxxx
10.1	Install NB port temporary cover and NB angle support bracket	This is done while the completed vessel is on the support stand. The temporary cover may be installed during step 1.1.5 if it has been fabricated. The NB angle support bracket must be install at this stage.
10.2	Set for VV removal	Rotate VV to horizontal position. Secure in place by bolting down support axle cradle top support blocks. Install quick release pin. Remove worm gear and install hoist ring.
10.3	Remove completed VV from support stand	Lift VV with crane and reposition to a vertical position with the worm gear side of the vessel in the down position.
10.4	While on the crane install base support plate	see figure below
11.0	Mount completed VV (period 2) on Stage 3 stand	see figure below.
11.1	Perform metrology alignment to orient the VV on Stage 3 stand.	Details of this step will be defined at a later time.



ALL CABLING MUST BE ABLE TO CONTACT HOT SURFACE OF 380°C WITHOUT DAMAGE. IF IT CAN'T IT SHOULD BE PROTECTED.